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Influence of urban land cover changes for the exposure of European cities to flooding during high-intensity rainfall events.

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Abstract

The extent and location of impervious surfaces within urban areas due to past and present city development strongly affects the amount and velocity of run-off during high-intensity rainfall and consequently influences the exposure of cities towards flooding. The frequency and intensity of extreme rainfall are expected to increase in many places due to climate change and thus further exacerbate the risk of pluvial flooding. Improved knowledge of the impacts of both urban land cover changes and climate change towards the risk of flooding in urban areas is needed when planning for climate proof cities. This paper examines the influence of recent changes in urban land cover, under present and future climatic conditions, on the exposure of cities to pluvial flooding. Eight European cities are included in the analyses, representing different climatic conditions and historical urbanisation trends within Europe. A combined hydrological-hydrodynamic modelling and remote sensing approach is used to simulate the occurrence of a range of extreme rainfall events under current and expected future climatic conditions, and for different levels of urbanisation, which corresponds to historical (1984) and current (2014) urban land cover. Landsat satellite imagery are analysed to quantify historical changes in impervious surfaces. The outputs of the remote sensing analyses are combined with regionally downscaled estimates of current and expected future rainfall extremes to enable 2D overland flow simulations and flood hazard assessments, and to compare the relative influence of land cover changes with that of expected climate change. Preliminary results confirm that recent land cover changes within major European cities can play a central role for the cities' exposure to flooding.